MONTANA DEPARTMENT OF FISH, WILDLIFE AND PARKS
FISHERIES DIVISION

JOB PROGRESS REPORT

STATE: MONTANA PROJECT TITLE: STATEWIDE FISHERIES INVESTIGATIONS

PROJECT NO.: F-46-R-4 STUDY TITLE: SURVEY AND INVENTORY OF COLDWATER LAKES

JOB NUMBER: II-b

JOB TITLE: WEST CENTRAL MONTANA COLDWATER LAKE INVESTIGATIONS

PROJECT PERIOD: JULY 1, 1990 THROUGH JUNE 30, 1991

ABSTRACT

Average length of January angler caught kokanee salmon was 8.7 inches. Growth increment from 2+ to 3+ January sampled kokanee was 1.4 inches. Average lengths of 2+ and 3+ kokanee were 7.9 and 9.3 inches respectively.

Average length of angler creeled rainbow trout from Georgetown Lake was 13.9 inches in January 1991. This is an increase of 0.5 inch from January 1990. The 1991 January rainbow catch was composed of 93% Arlee, 3% Eagle Lake and 4% Kamloops. Low percent contributions of the Eagle Lake strain appears to be the result of late stocking dates in 1988 and 1989. Average length of Kamloops increased from 11.5 inches in 1990 to 15.1 inches in 1991. This reflects returns of 1989 stocked Kamloops of 8.3 inch average length which averaged 11 inches in 1990 and 15.1 inches in 1991.

Brook trout comprised 14% of the January, 1991 trout catch averaged 13.1 inches in length and had a maximum length of 16.9 inches. Brook trout numbers appear to be stable or increasing. Size of brook trout sampled has increased from 11.8 to 13.1 inches from 1980 to 1991.

Spring spawning rainbow trout averaged 17.6 inches in length. Forty-two percent of spawners were greater than 18 inches and 10% were greater than 20 inches, almost exactly the same as 1990. Late ice out and early opening season date resulted in harvest of large numbers of adult rainbow. Alternative regulations to reduce the number of spawners vulnerable to early harvest are under review.

Under ice oxygen included concentrations in excess of 5 ppm at depths of 2m or more throughout the season.

OBJECTIVES AND DEGREE OF ATTAINMENT

1. Develop an average size rainbow trout in the Georgetown Lake winter creel to 14 inches.

   Average length of January 1991 angler caught rainbow trout was 13.9 inches. It is possible that the 0.5 inch increase in average length from 1990 to 1991 resulted from a reduction in survival of 1988 and 1989 Eagle Lake rainbows due to late stocking dates. The absence or reduced percentage of these fish in the catch would tend to increase average size of creeled rainbows.

2. Develop a current mountain lake data base on all mountain lakes in Region 2. (State funded)

   Mountain lake initial surveys are almost complete. Management changes have been effected on most and evaluation of the consequences of these changes is planned within three years.

3. Develop mountain lake management plans for ecological units emphasizing wild trout.

   Progress in this category was minimal in order to allow sufficient time to pass for new management strategies to be accurately evaluated.

4. Increase trout populations to produce overnight gill net catches of 5 fish per net and mean size of 12 inches. (State funded)

   Addressed in 1991 Performance Report.

5. Increase yellow perch mean size to 9 inches. (State funded).

6. Increase size of kokanee in the creel to 10 inches or greater in the Georgetown Lake winter fishery.

   Average size of kokanee remained at 8.7 inches in length.

PROCEDURES

Changes in management practices at Georgetown have included the reduction of trout limits from 10 rainbow and 20 brook trout to 5 trout of any combination of species. Stocking of rainbows was changed from 100% Arlee to 1/3 Arlee, 1/3 Eagle Lake and 1/3 Kamloops in order to utilize less catchable and more piscivorous strains. Stocking numbers have been reduced from 250,000 to 180,000 to avoid growth rate reductions as the number of trout surviving has increased with the reduced catch limits. The development of natural reproduction will require further reductions in number of rainbows stocked.

Efforts to increase kokanee average size can only succeed if numbers of kokanee are reduced. Stream spawning kokanee were eliminated in the late seventies and early eighties. Spawning in springs within the lake has been sufficiently successful to compensate for the loss of reproduction in the tributaries and kokanee size has not increased significantly. Unlimited catch regulations were similarly ineffective in reducing kokanee numbers. The introduction of Kamloops and Eagle Lake rainbows to prey on kokanees may be successful but will require additional years of observation to determine.

Development of rainbow trout spawning runs were first documented in 1989 when substantial numbers were recorded in Stuart Mill Creek and the North Fork of Flint Creek. Data collection from spawners was expanded in 1990. Strain identification of spawning rainbows was achieved by starch-gel electrophoresis of fin tissues clipped from spawners and analyzed by the Genetics Laboratory at the University of Montana. Monitoring of 1991 spawning runs was reduced to a single sample of 96 rainbows.

RESULTS AND DISCUSSION

Kokanee Salmon

Kokanee salmon are major contributors to the winter Georgetown fishery. Average size of angler caught kokanee was 8.8 inches in 1989, 8.7 inches in 1990, and 8.7 inches in 1991 (Table 1). Second to third year growth increment from 1990 to 1991 averaged 1.4 inches, similar to previous years (Table 2). Length frequencies of January angler caught kokanee are displayed in Figures 1-8. No significant changes in the kokanee population are evident from the data.

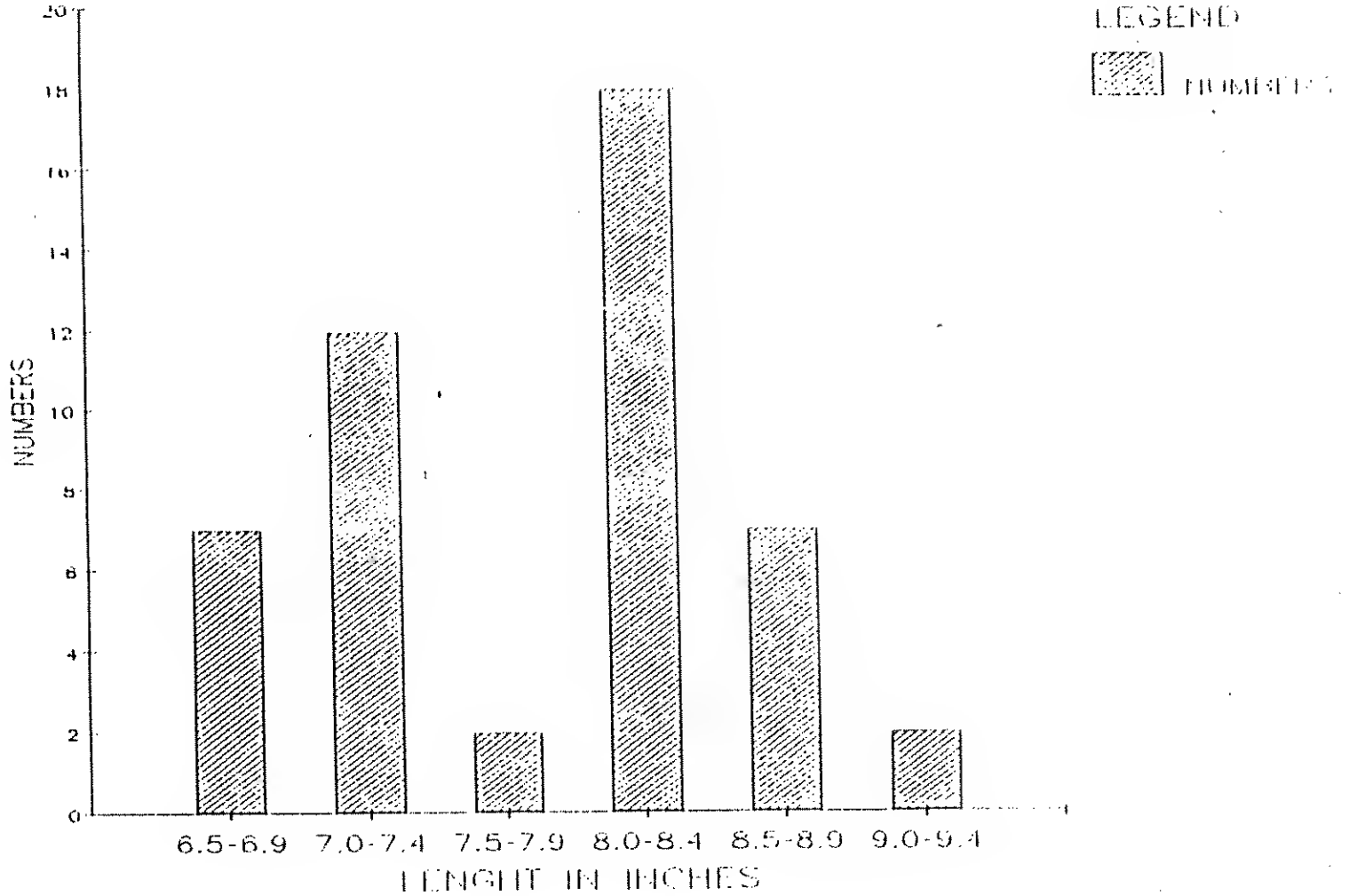
Table 1. Georgetown Lake Kokanee Average Lengths in Winter Angler Creel

Year	66-67	67-68	68-69	69-70	70-71	71-72	72-73	73-74
Sample Number	34	55	No	20	149	717	302	No
Average Length	12.3	10.7	data	11.4	10.9	10.6	9.9	data
Year	74-75	75-76	76-77	77-78	78-79	79-80	80-81	81-82
Sample Number	No	14	346	194	119	7	127	No.
Average Length	data	11.5	10.8	9.2	7.9	8.2	8.4	data
Year	82-83	83-84	84-85	85-86	86-87	87-88	88-89	89-90
Sample Number	No	46	96	133	187	384	403	205
Average Length	data	7.8	8.2	9.1	8.6	9.4	8.8	8.4
Year	90-91							
Sample Number	208							
Average Length	8.7							

Table 2. Georgetown Lake Kokanee 2nd to 3rd Year Growth Increment in January Angler Creel Sample

	78	79	80	81	84	85	86	87	88	89	90	91
2+ average length	7.8	6.9	7.2		6.9	7.2	7.5	7.5	8.2	7.9	7.9	7.7
3+ average length		8.7	8.3	8.8		8.4	9.3	9.2	9.7	9.5	9.3	9.3
average growth		0.9	1.4	1.6		1.5	2.1	1.7	2.2	1.3	1.4	1.4

Figure 1. Georgetown Lake kokanee length-frequency in January 1984 angler creels. N=417



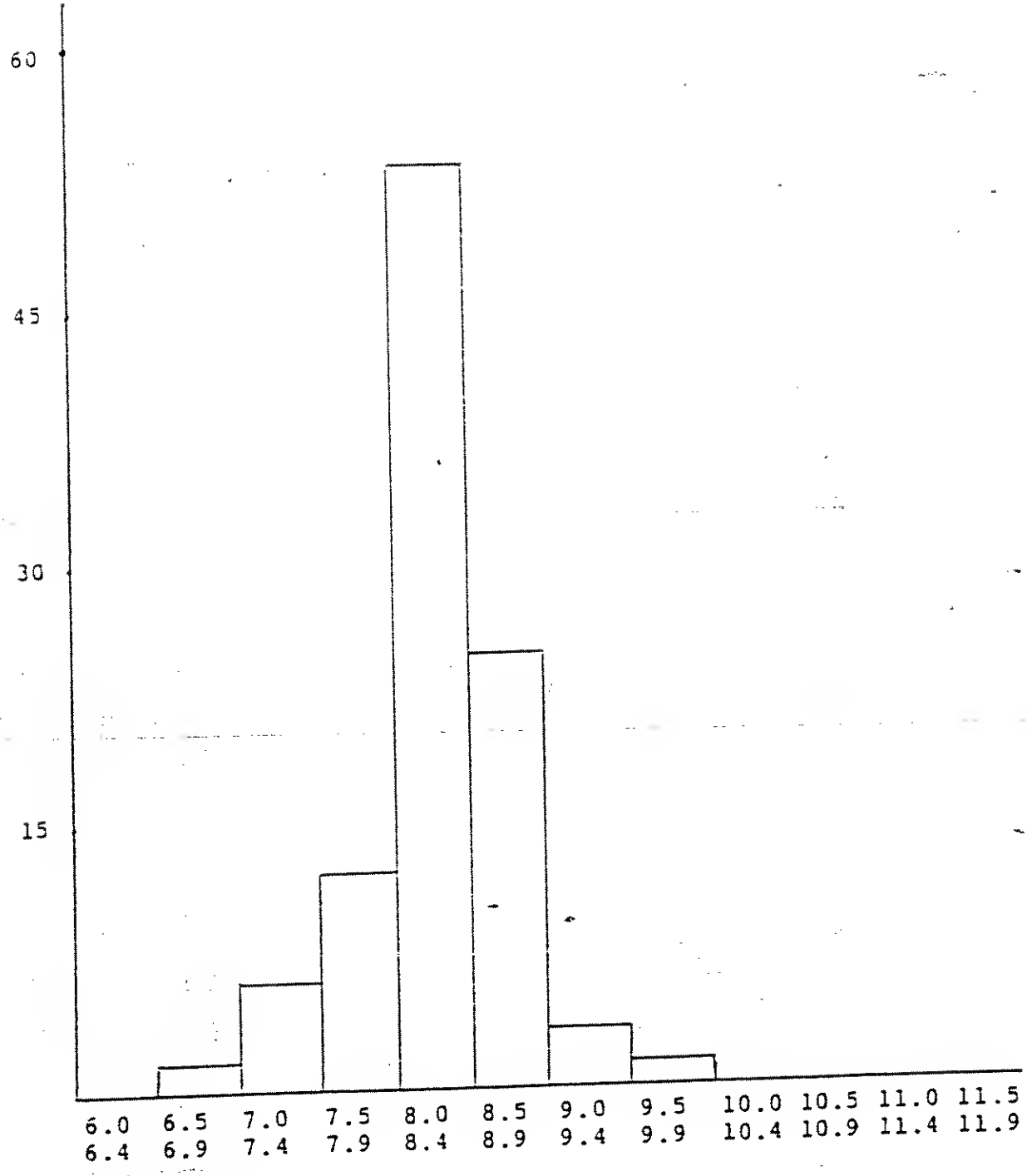


Figure 2. Georgetown Lake Kokanee Length-Frequency in January 1985 Angler Creel. N = 96

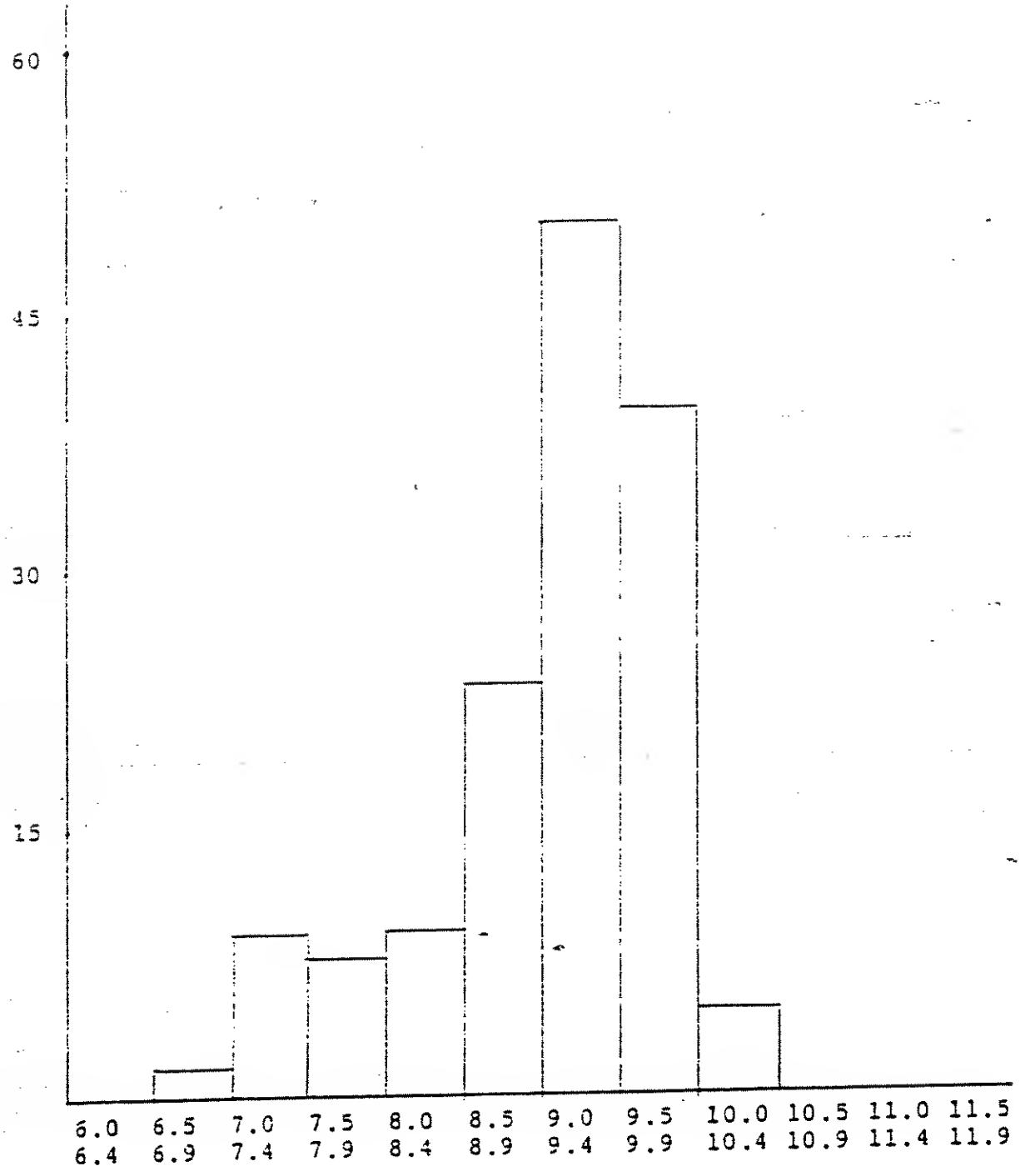


Figure 3. Georgetown Lake Kokanee Length-Frequency in January 1986 Angler Creel. N = 133

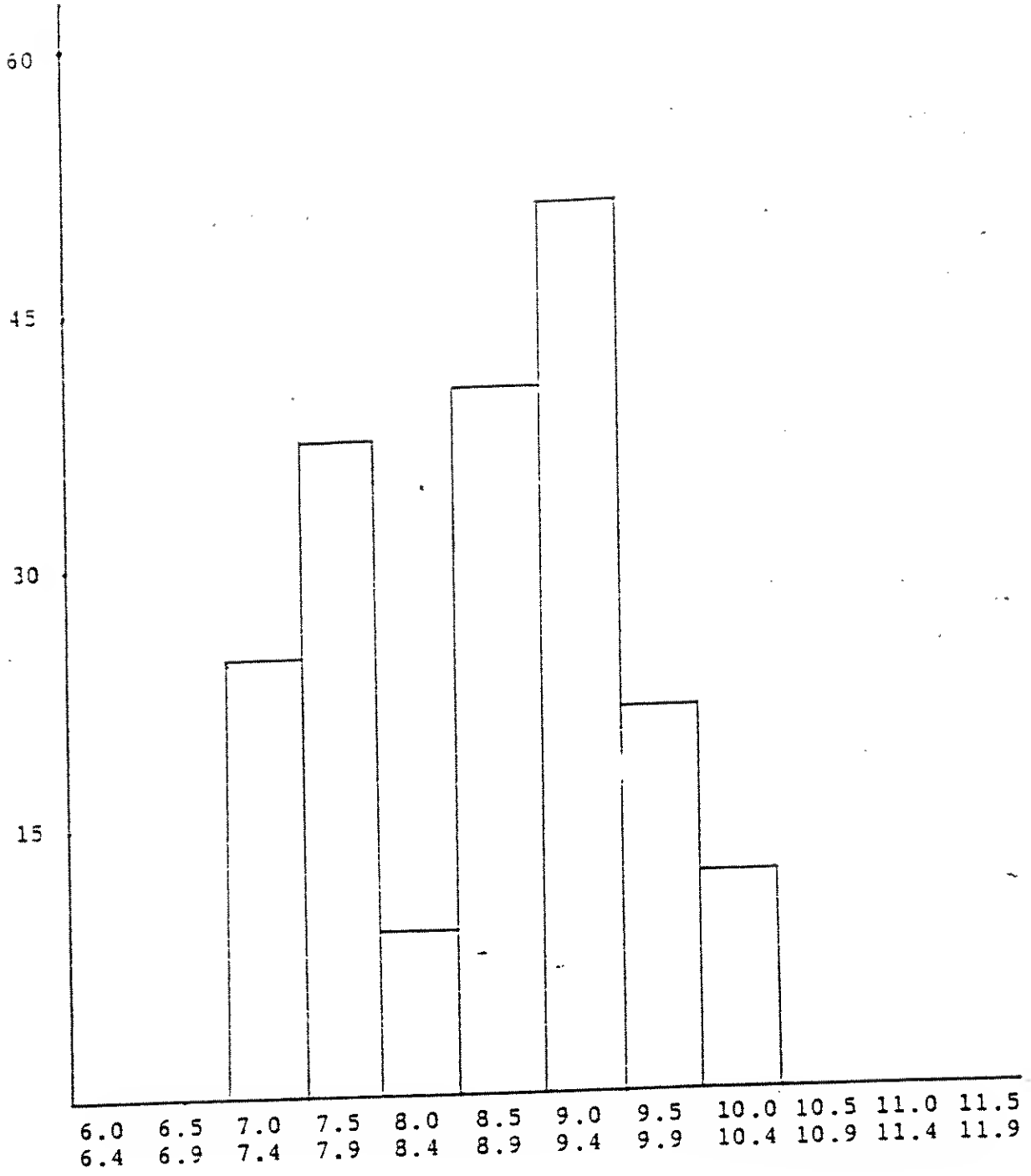


Figure 4. Georgetown Lake Kokanee Length-Frequency in January 1987 Angler Creel. N = 187.

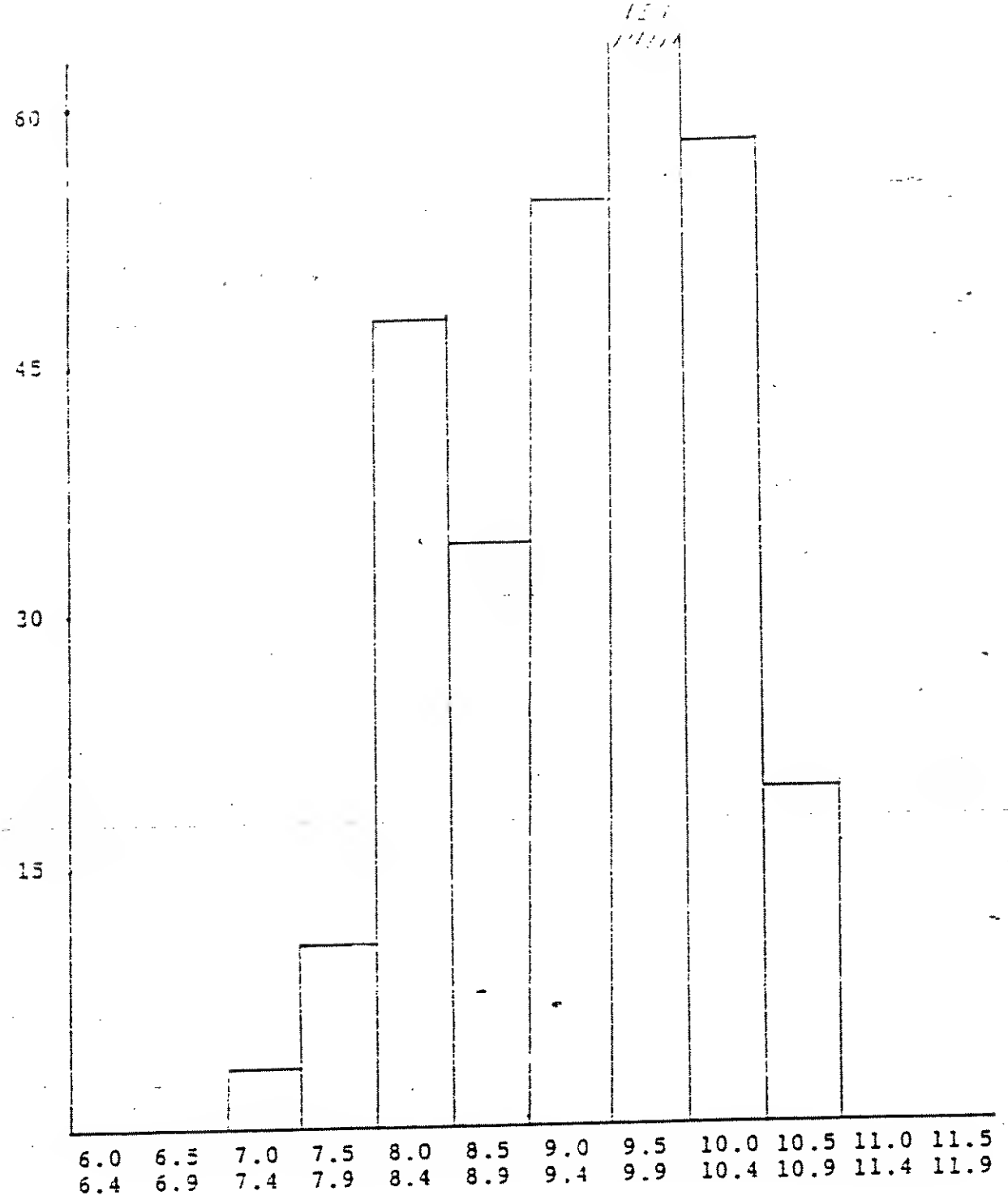


Figure 5. Georgetown Lake Kokanee Length-Frequency in January 1988 Angler Creel. N = 387.

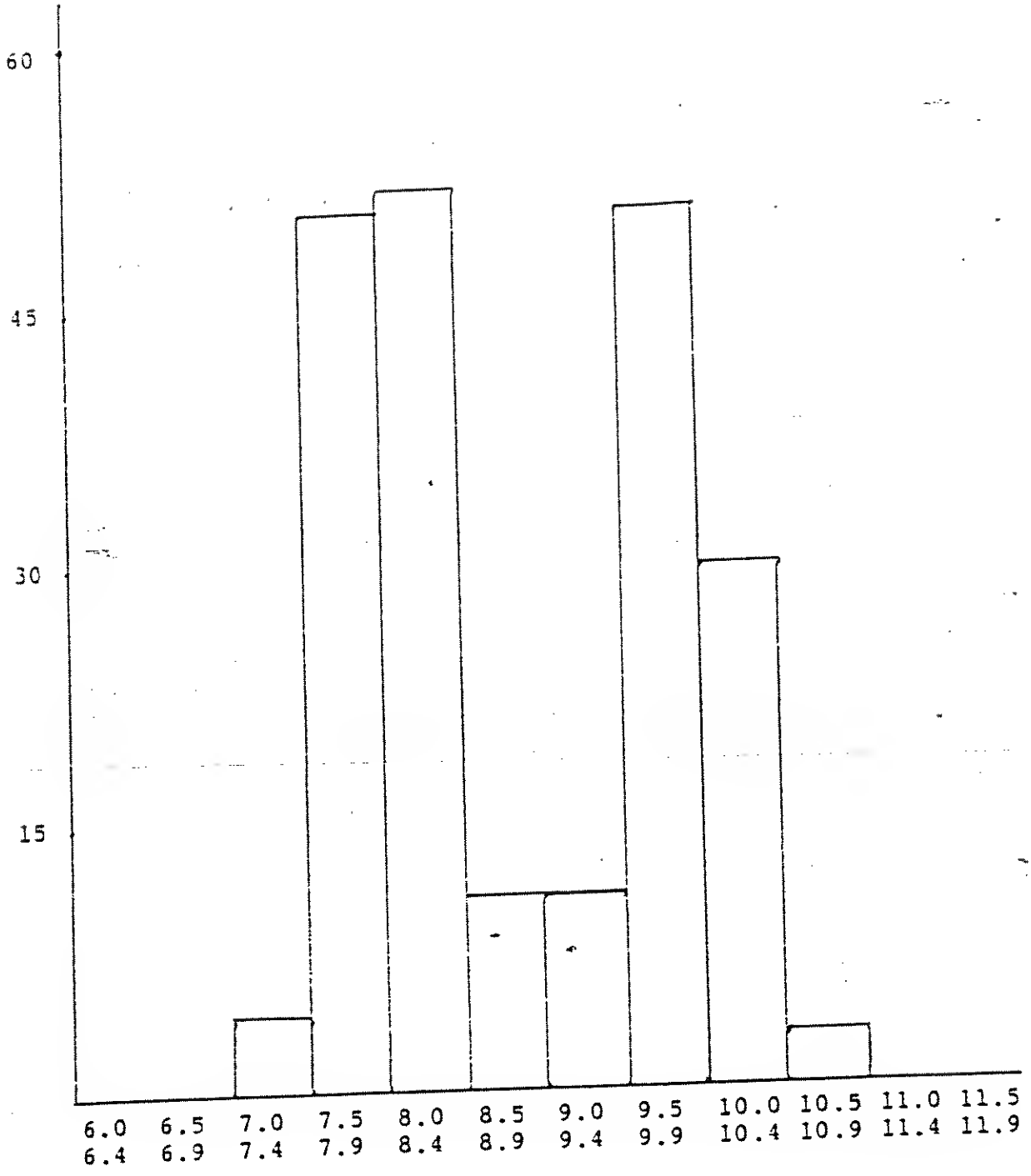


Figure 6. Georgetown Lake Kokanee Length-Frequency in January 1989 Angler Creel. N = 200.

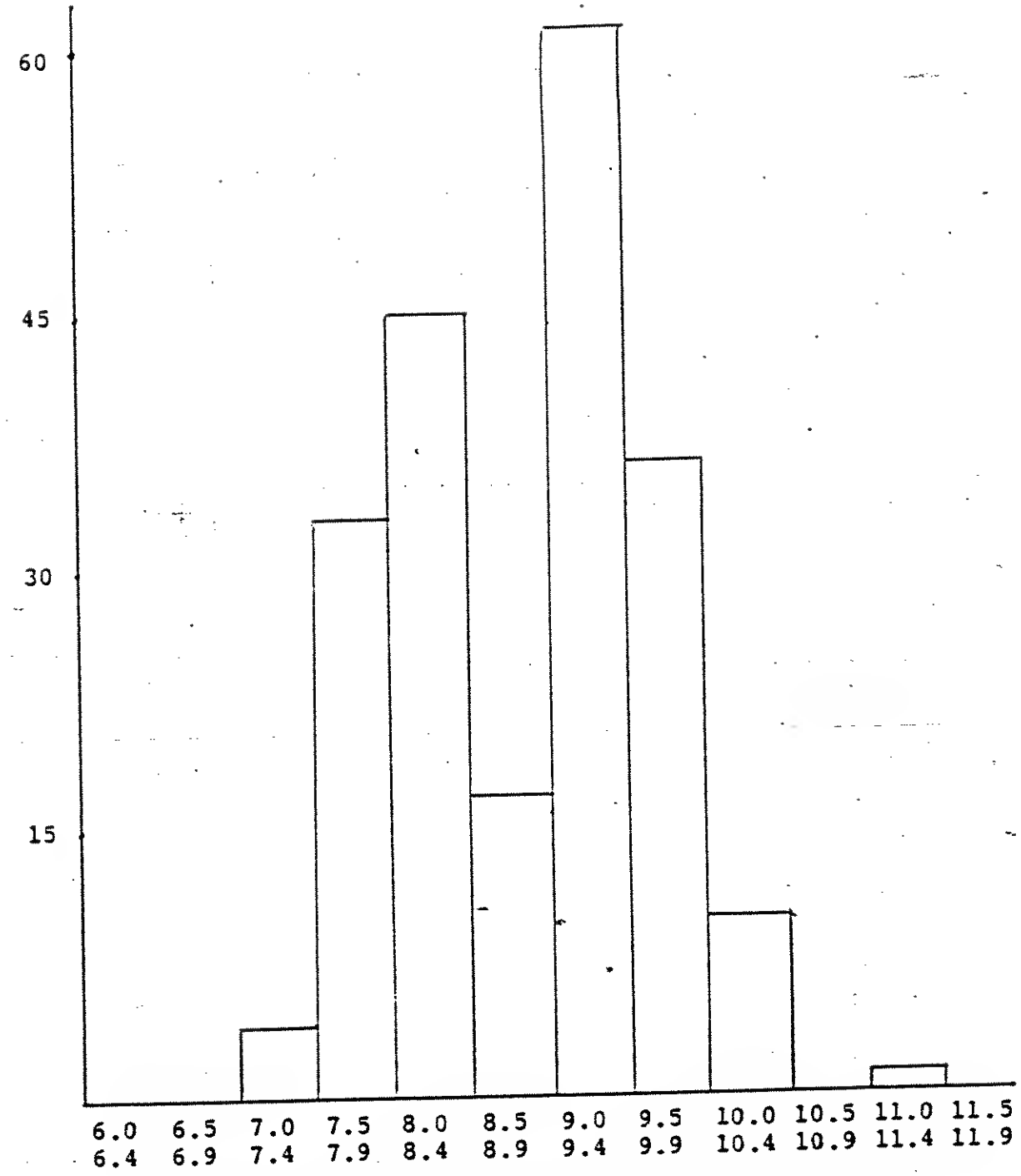


Figure 7. Georgetown Lake kokanee length-frequency in January 1990 angler creel N = 205

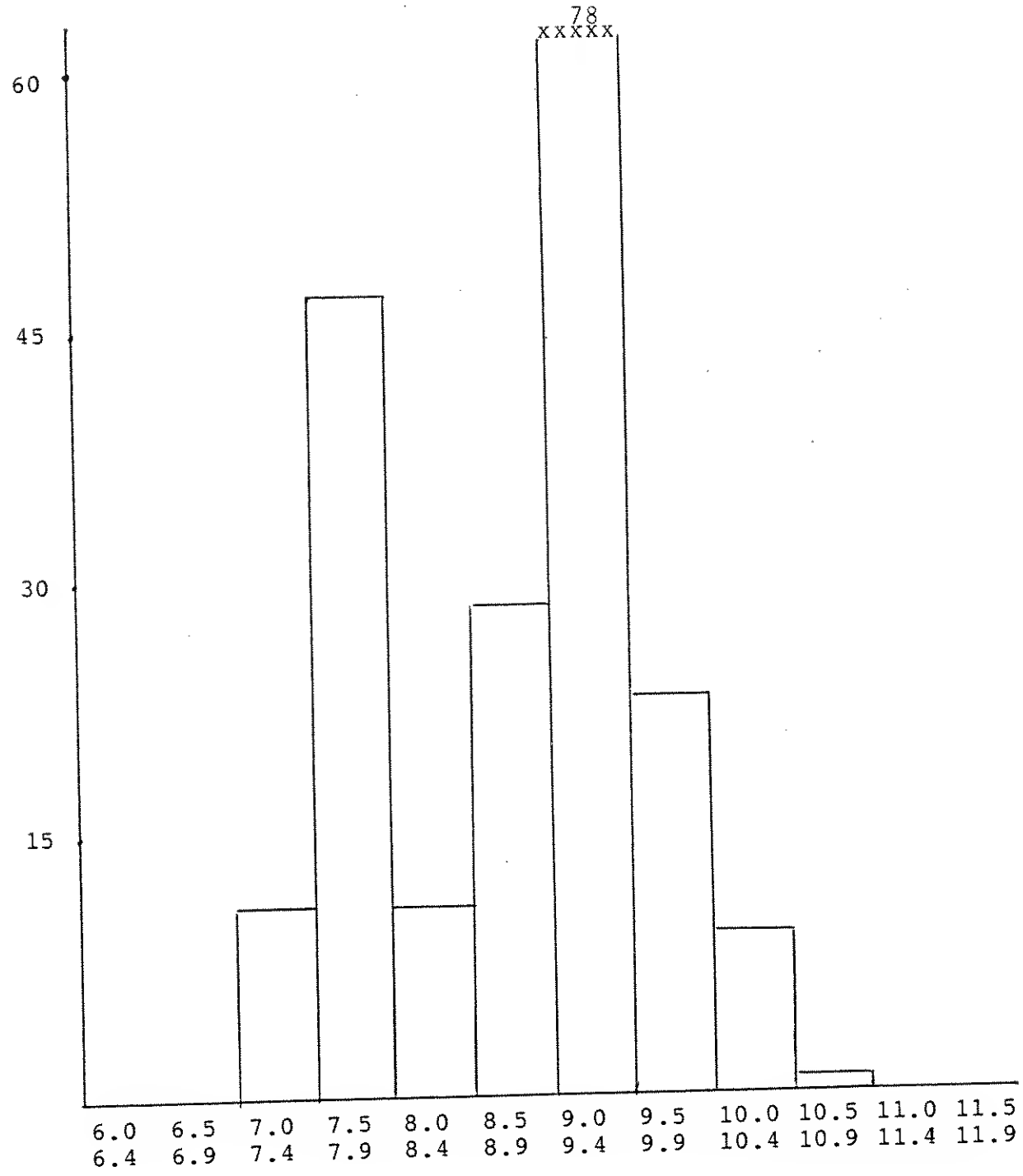


Figure 8. Georgetown Lake kokanee length-frequency in January 1991 angler creel. N=208.

Brook Trout

Brook trout are a small but highly prized component of the Georgetown fishery. Creel sample data for brook trout are shown in Table 3. Brook trout sampled in 1991 averaged 13.1 inches in length with a maximum of 16.9 inches. Brook trout comprised 14% of the 1991 January trout catch. Average size of Georgetown brook trout samples has increased slowly since 1980 by an increment of 2.3 inches. Brook trout contribution to the catch has also shown a gradual increase. The Georgetown brook trout population seems to be in good condition and increasing in both size and numbers.

Table 3. Georgetown Lake Creel Samples of Rainbow and Brook Trout.

	Summer		Winter						
	1979	1980	1980	1981	1987	1988	1989	1990	1991
Number Sampled									
Rainbow	88	774	141	730	244	303	221	305	302
Brook	4	124	11	123	18	57	23	47	45
Brook Trout Length									
Average	10.1	10.	11.8	11.1	12.1	12.1	12.2	12.0	13.1
Maximum					17.2	16.5	16.0	17.2	16.9
Rainbow to Brook Ratio	22:1	6:1	13:1	6:1	14:1	5:1	10:1	6:1	6:1
Brook Trout % of Catch	4	14	7	14	7	16	9	15	14

Rainbow Trout

Rainbows are the most important trout in the Georgetown harvest in both numbers and poundage. Rapid increases in rainbow size followed regulation changes in 1985 (Table 4). This appears to have resulted from reduction in angling mortality and a consequent increase in life expectancy. The 1991 angler harvested rainbows increased in average length from 13.4 in 1989 and 1990 to 13.9 inches. While the 0.5 increase in length appears real, it probably does not reflect an actual increase in number of larger fish, but a decrease in abundance of small sized fish.

Table 4. Georgetown Lake Rainbow Average Lengths in Winter Angler Creel

Year	66-67	67-68	68-69	69-70	70-71	71-72	72-73	73-74
Sample Number	214	306	No	247	555	1407	888	No
Average Length	11.7	11.3	data	11.1	10.1	10.6	10.7	data
Year	74-75	75-76	76-77	77-78	78-79	79-80	80-81	81-82
Sample Number	No	45	247	171	165	30	124	No
Average Length	data	10.4	10.6	10.0	9.9	11.2	9.7	data
Year	82-83	83-84	84-85	85-86	86-87	87-88	88-89	89-90
Sample Number	No	3	42	296	242	303	227	305
Average Length	data	9.7	9.8	11.5	12.8	12.8	13.4	13.4
Year	90-91							
Sample Number	302							
Average Length	13.9							

A major feature of the new management strategy at Georgetown was a change from the sole use of Arlee rainbow to the use of a total rainbow stocking composed of 1/3 Arlee, 1/3 Eagle Lake, and 1/3 Kamloops. The performance of the 3 strains has been compared through the years. Arlee are unmarked, Eagle Lake are tetracycline marked and Kamloops are adipose clipped. Comparison of rainbow strain performance may be made utilizing the data in Table 5. Arlee enter the fishery during their first months in the lake since they are stocked as 6 inch fish in June. Growth through the summer allows them to reach sizes desirable to some anglers. Eagle Lake rainbows are stocked in late August or early September due to their later spawning date and are not normally a part of the catch until the following June. Kamloops are planted in September at even smaller size than Eagle Lake and do not enter the fishery until the following summer.

The percent of each of the three strains in the annual catch is presented in Table 5. Arlee rainbow dominated the catch in 1985-86 and 1986-87 at 70% of the harvest in both years. Arlee contribution declined in 1987-88 (63%) and 1988-89 (52%). The percentage Arlee in the catch was 59% in 1989-90 but shot to 93% in 1990-91. These percentages appear to be a function of early success of Eagle Lake rainbow plants followed by near total failure of plants of this strain in 1988, 1989, and 1990. The plants with poor survival were made too late in the season, late September-November. This situation will be corrected in 1991. While no data have been collected on catch rates of rainbow, it was apparent in 1991 that the rate was substantially lower than in previous years.

Figures 9-22 present length frequency data for Arlee, Eagle Lake and Kamloops rainbows. After the first years of new regulation, 1986-1989 (Figures 9-12), Arlee size distribution increased substantially. In years 1990 and 91 (Figures 13-14) increase in Arlee size slowed and may have decreased slightly.

Eagle Lake rainbow performance has been discussed, in part, previously. Like Arlee rainbow, Eagle Lake sizes increased from 1986 through 1989 (Figures 15-18). In Table 5, it can be seen that Eagle Lake average size increased substantially in 1990 and 1991 (Figures 19 and 20). These increases result from the stocking failures of 1988 and 1989. It is likely that further increases in average size and decreases in percent of rainbow catch will be observed for Georgetown Eagle Lake due

to the late stocking date in 1990. In 1986, the Eagle Lake plant received a double tetracycline mark. Average lengths of the 1986 tetracycline marked Eagle Lake were 12.5 inches in 1988, 15.2 inches in 1989, 15.7 inches in 1990, and 20.8 inches in 1991. These constitute growth increments of 2.7 inches in 1988-1989, 0.5 inches in 1989-1990, and 5.1 inches in 1990-1991. Eagle Lake strain rainbows have achieved weights in excess of six pounds in Georgetown.

Table 5. Georgetown Lake Rainbow Strain Evaluation, January Angler Creel 1986-91

	Sample No.	% Catch	Mean Length	Range (inches)
			1985-86	
Arlee	210	70	11.6	8.4-15.7
Eagle Lake	84	28	11.2	6.0-12.9
Kamloops	2	1	11.4	9.8-12.9
Total	296	100	11.5	6.0-15.7
			1986-87	
Arlee	169	70	12.6	7.7-16.8
Eagle Lake	70	29	13.6	8.3-16.4
Kamloops	3	1	11.1	9.3-14.8
Total	242	100	12.8	7.7-16.8
			1987-88	
Arlee	185	63	12.7	8.8-18.0
Eagle Lake	100	34	12.9	10.8-16.9
Kamloops	8	3	11.4	10.7-13.2
Total	293	100	12.8	8.8-16.9
			1988-89	
Arlee	85	52	13.6	9.2-19.3
Eagle Lake	71	44	13.9	11.1-18.4
Kamloops	6	4	12.6	10.6-15.8
Total	162	100	13.4	9.2-19.3
			1989-90	
Arlee	172	59	13.2	8.6-18.8
Eagle Lake	80	28	15.0	9.9-18.5
Kamloops	39	13	11.5	8.8-16.3
Total	291	100	13.4	8.6-18.8
			1990-91	
Arlee	282	93	13.1	6.7-19.0
Eagle Lake	8	3	17.6	15.1-20.8
Kamloops	11	4	15.1	10.7-16.6
Total	301	100	13.8	6.7-20.8

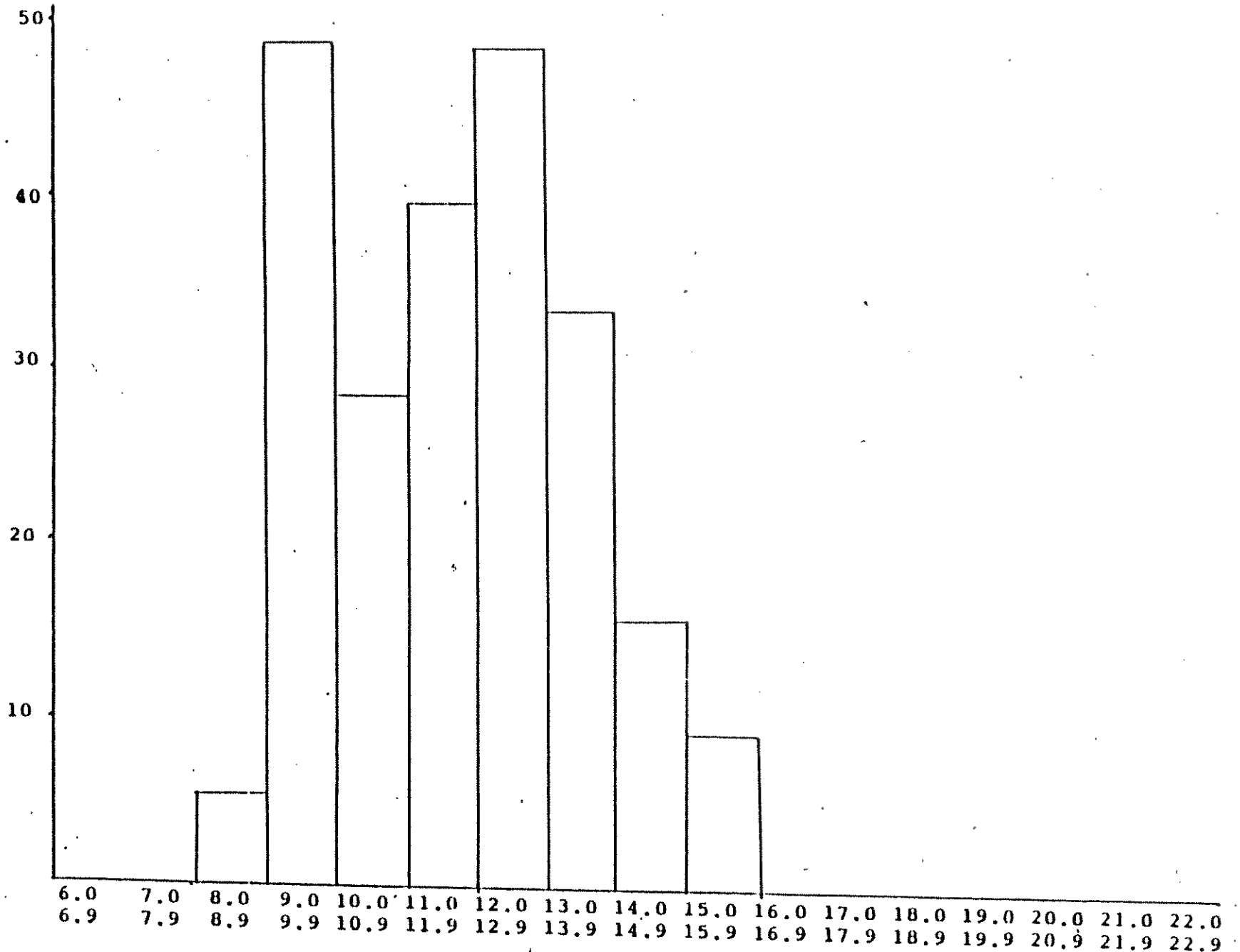


Figure 9 Length Frequency of Georgetown Arleo Rainbow. January 1986. N = 210

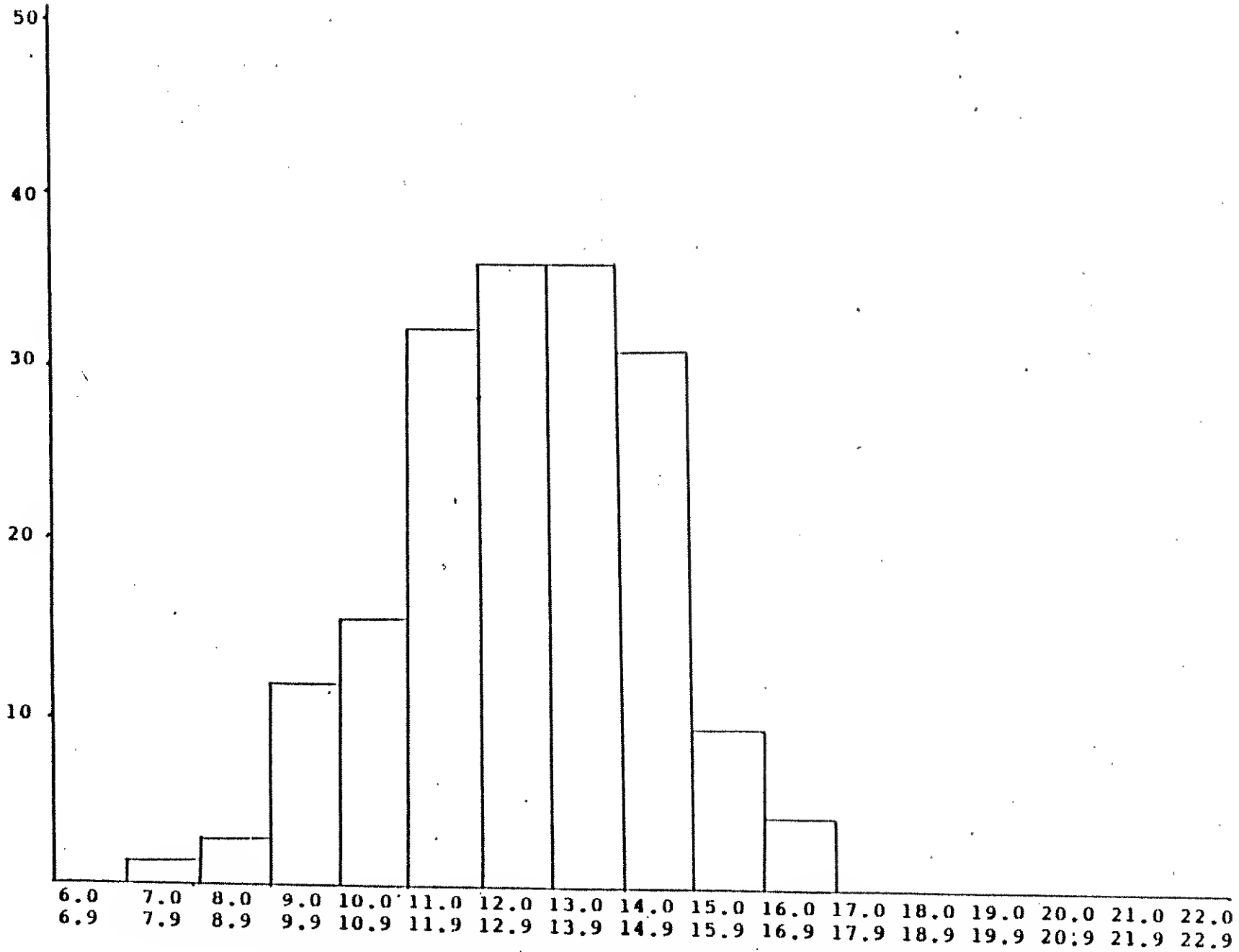


Figure 10 Length Frequency of Georgetown Arlee Rainbow. Winter 86-87. N = 169

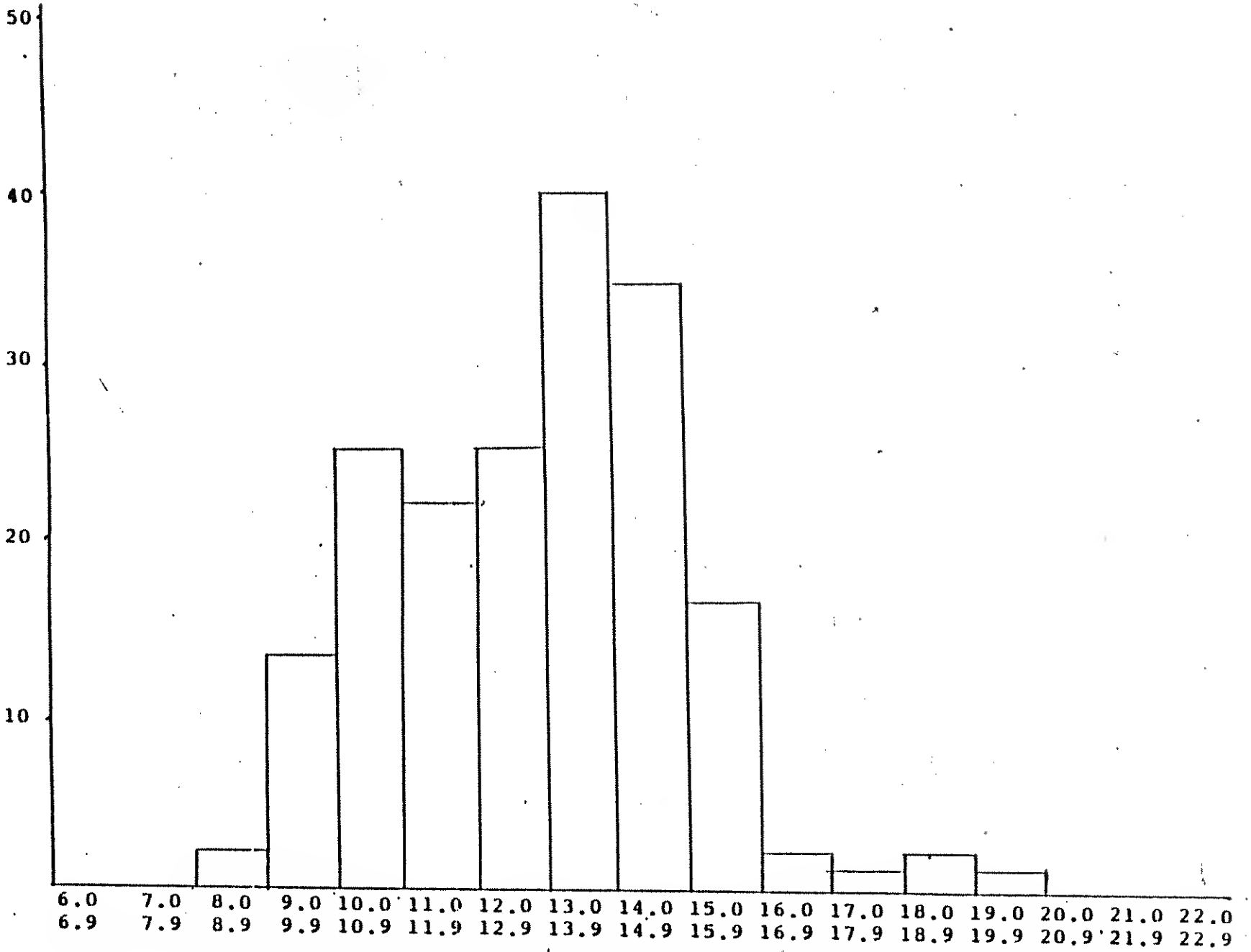


Figure 11 Length Frequency of Georgetown Arlee Rainbow. January 1988. N= 197

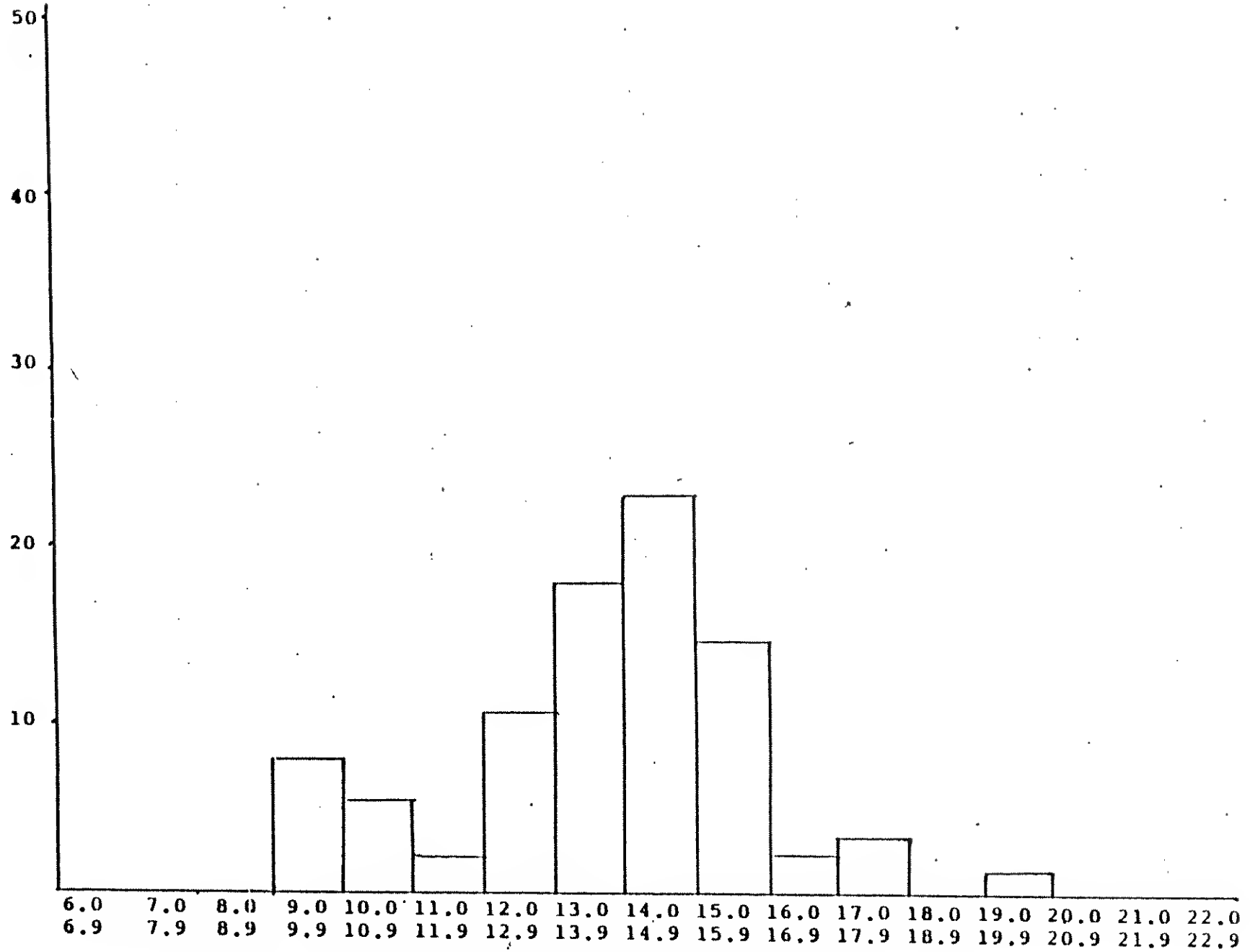


Figure 12 Length Frequency of Georgetown Artee Rainbow. January 1989. N = 87

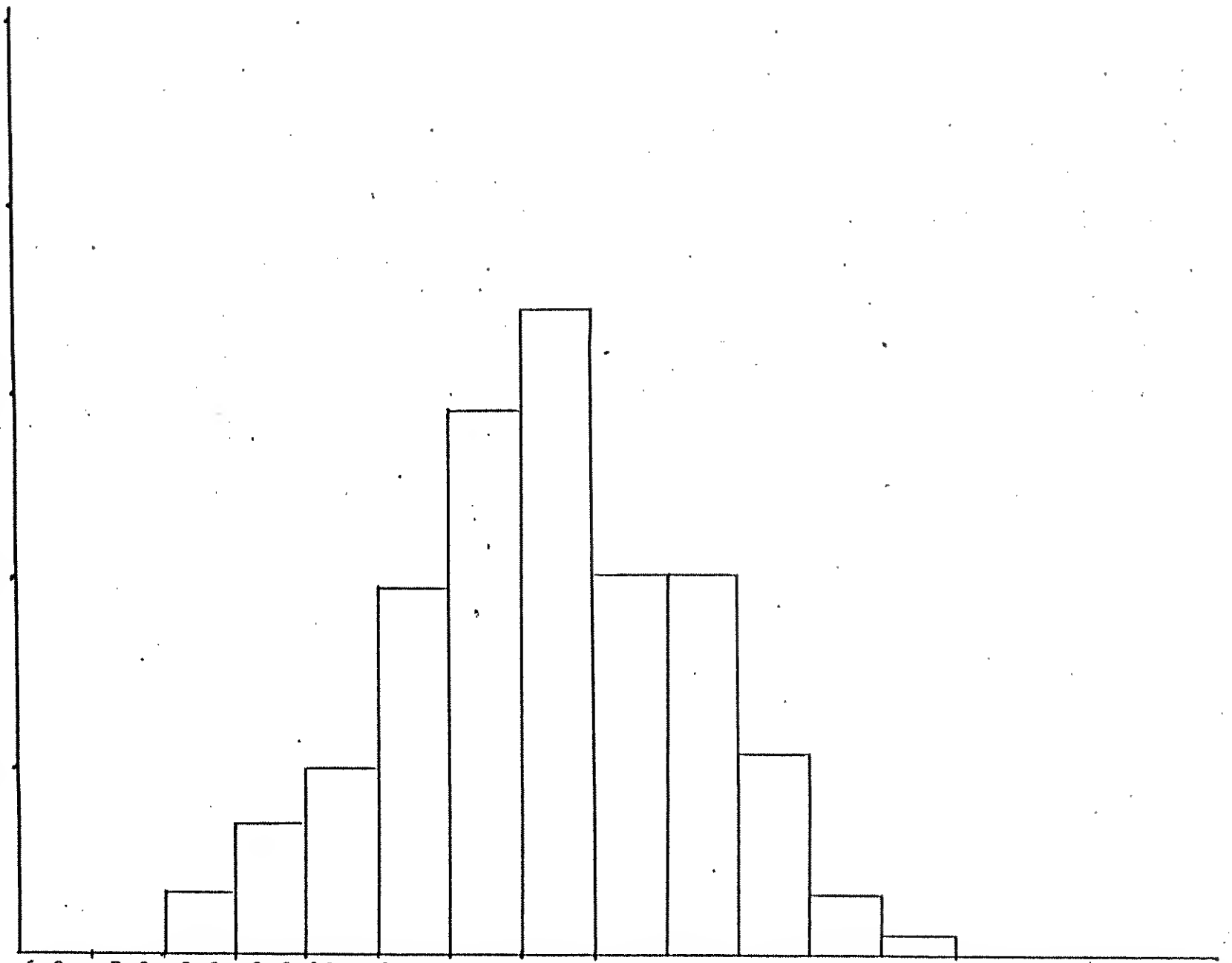


Figure 13 Length frequency of Georgetown Arlee Rainbow, January 1990. N = 174

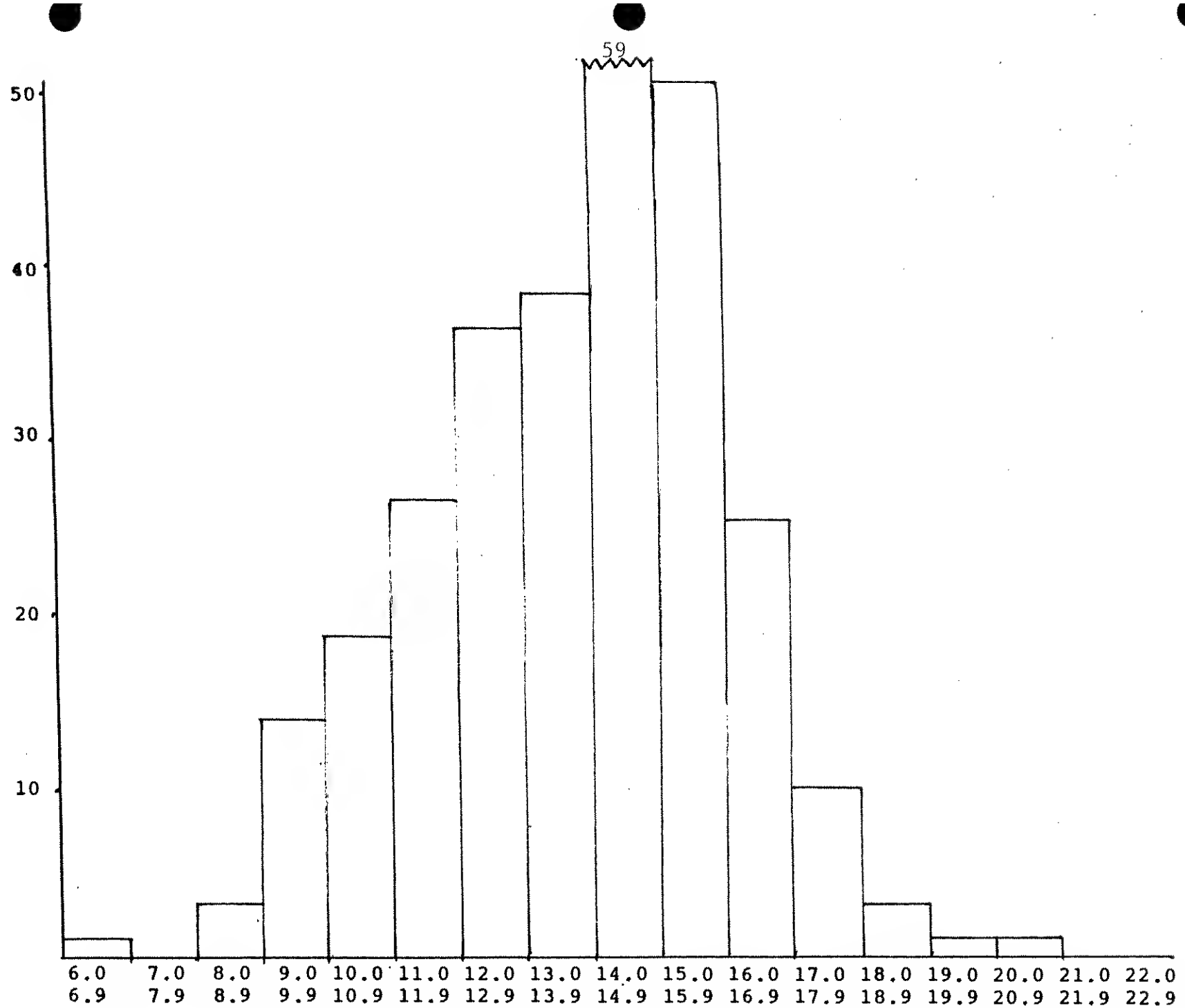


Figure 14. Length Frequency of Georgetown Arlee Rainbow, January 1991 N 282

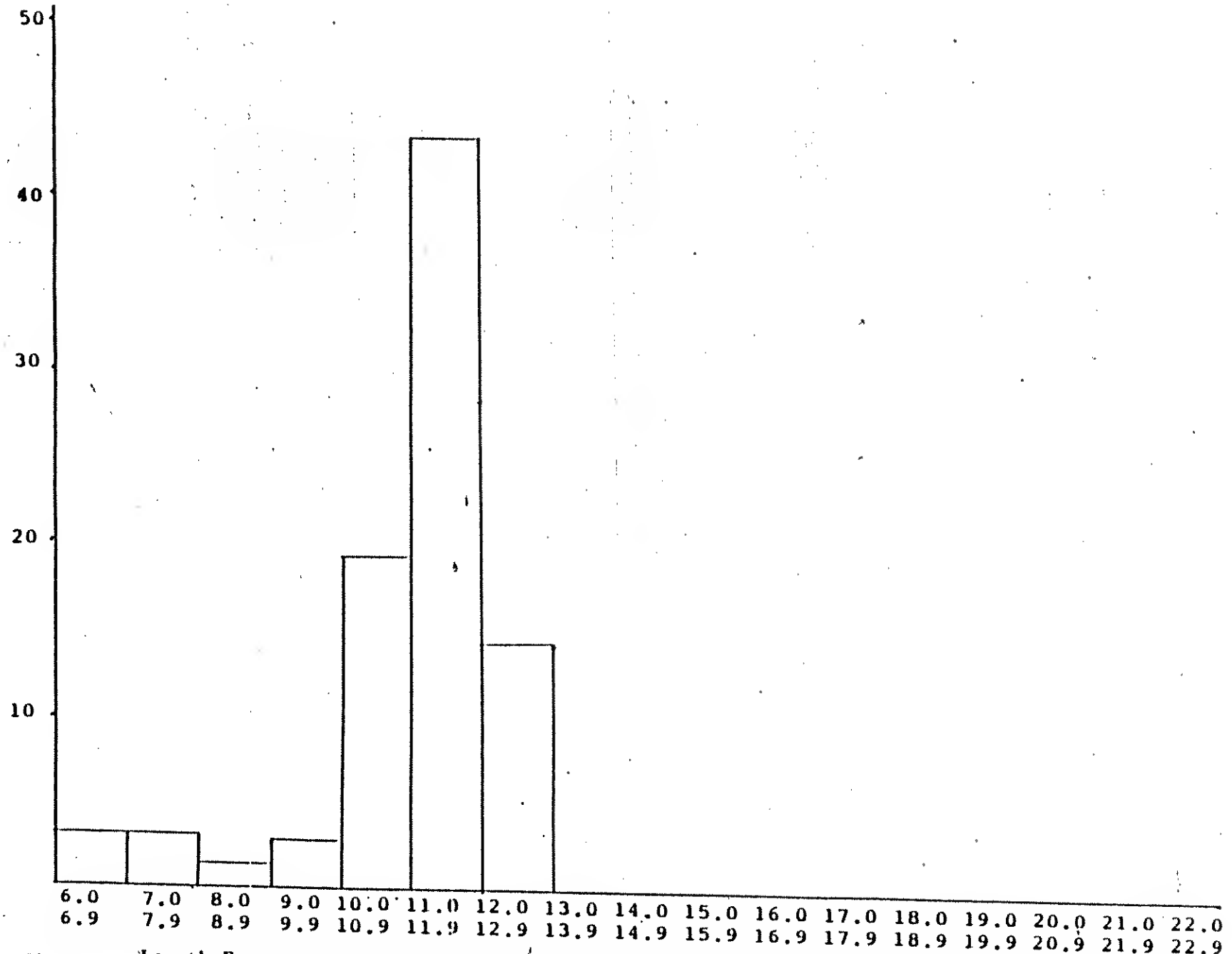


Figure 15 Length Frequency of Georgetown Eagle Lake Rainbow. January 1986. N = 84.

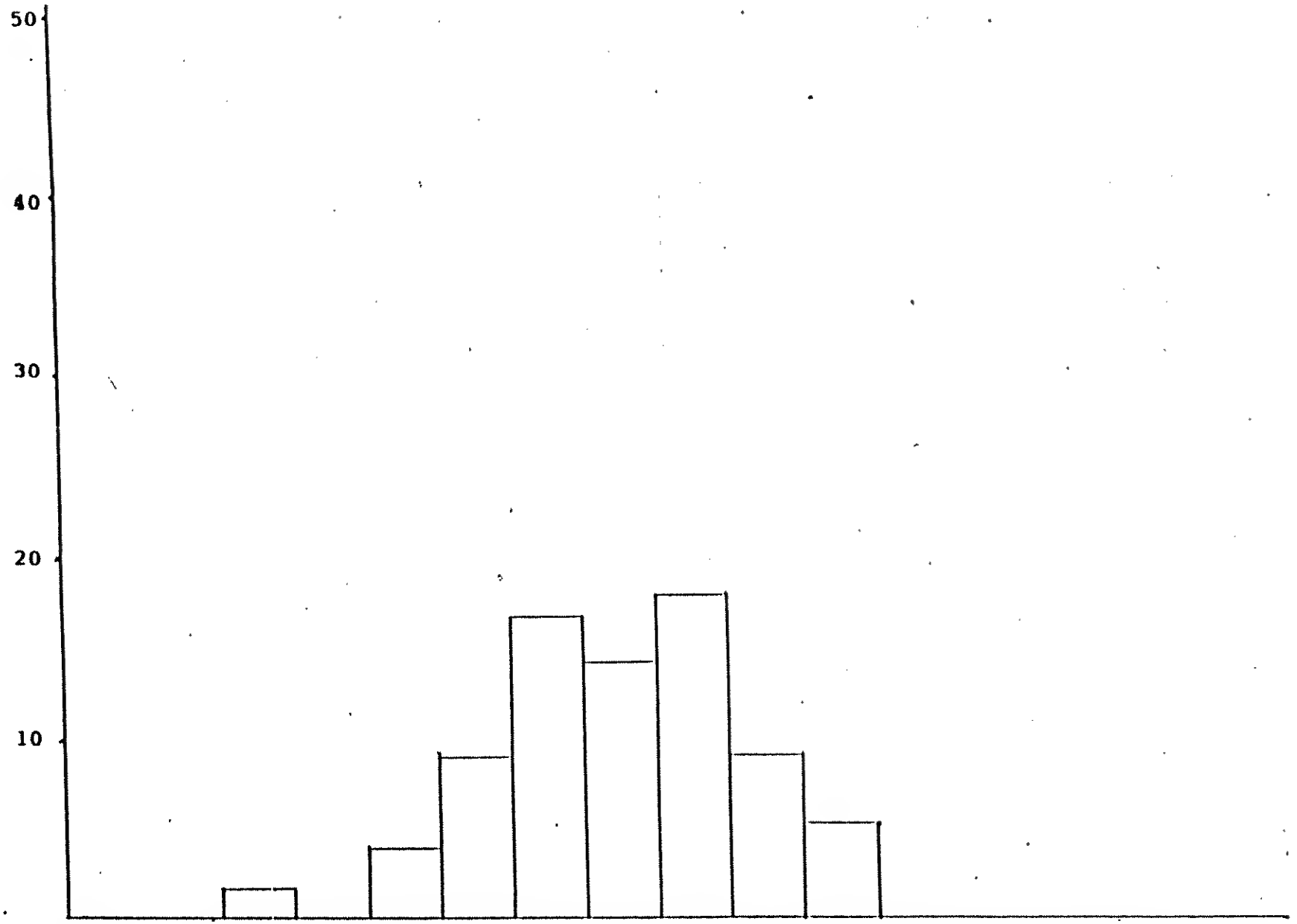
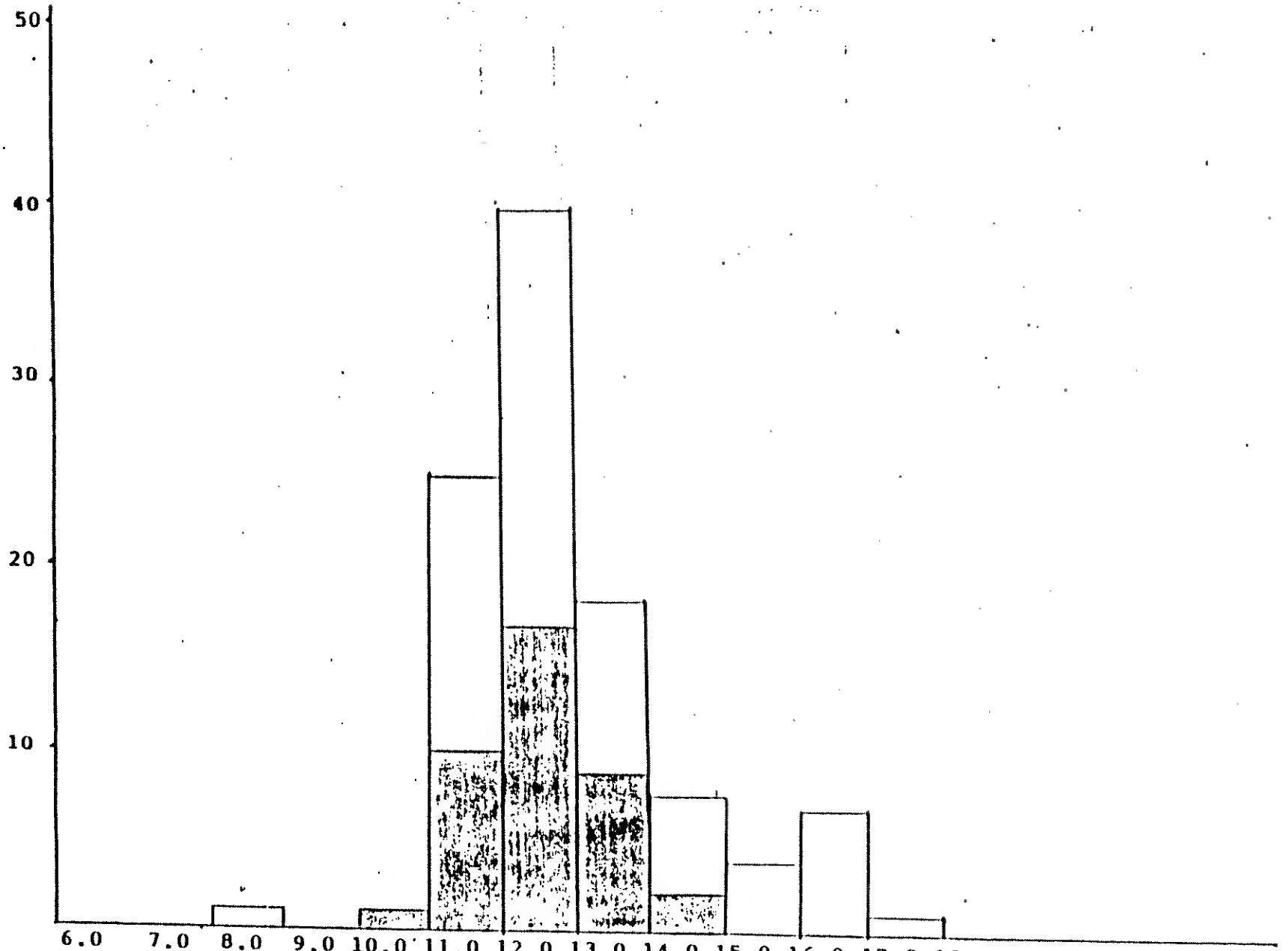


Figure 16 Length Frequency of Georgetown Eagle Lake Rainbow. January 1987. N = 70



Length Frequency of Georgetown Eagle Lake Rainbow. January 1988. N = 106

Figure 17 Shaded area 1986 plant N = 39

Length Frequency of Georgetown Eagle Lake Rainbow. January 1989. N = 71

Figure 18, Shaded area - 1986 plant N = 13

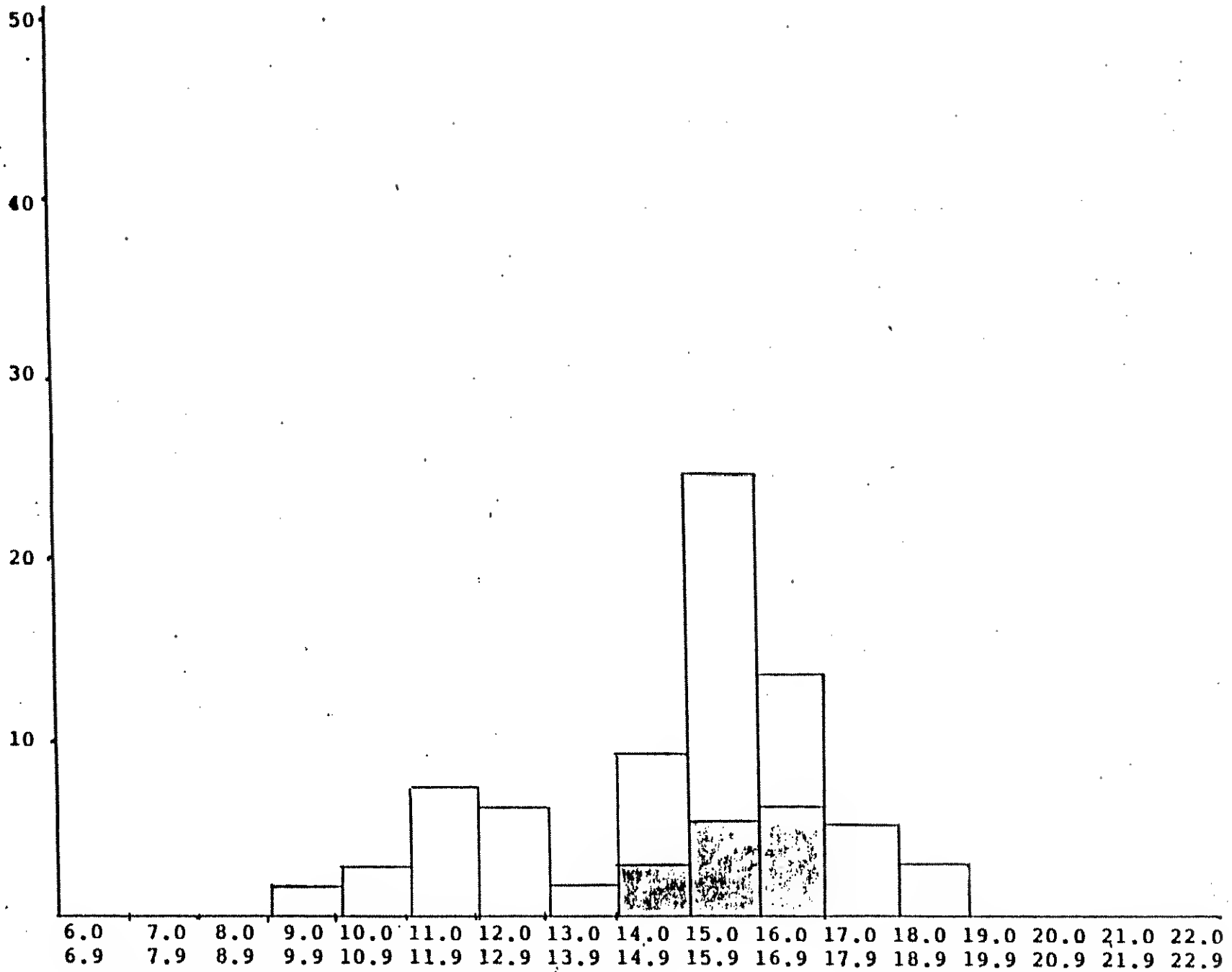


Figure 19 Length frequency of Georgetown- Eagle Lake Rainbow, January 1990 N = 80
Shaded - 1986 Plant N = 14

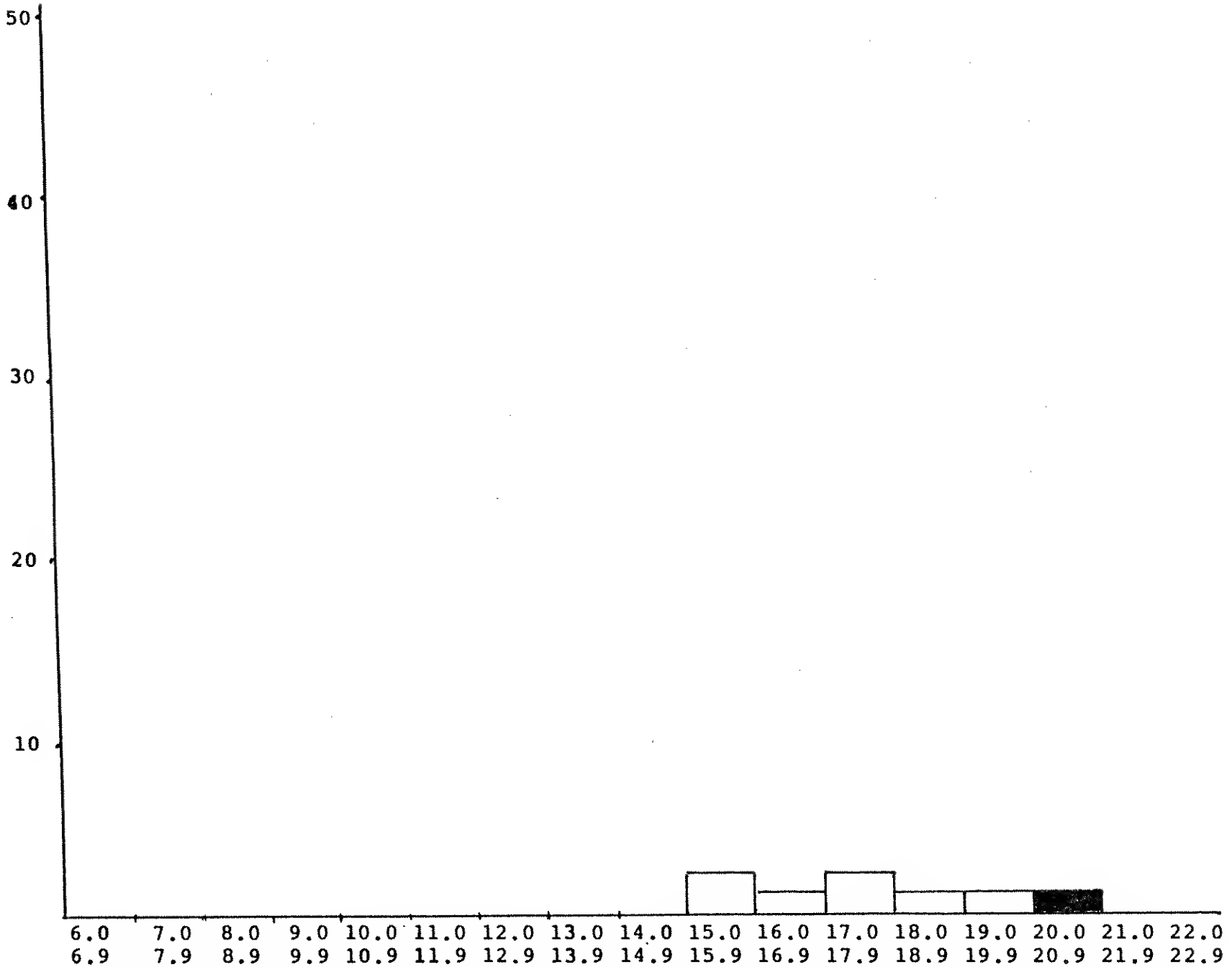


Figure 20. Length frequency of Georgetown Eagle Lake Rainbow. N-8. Shaded area 1986 plant. N-1 January 1991

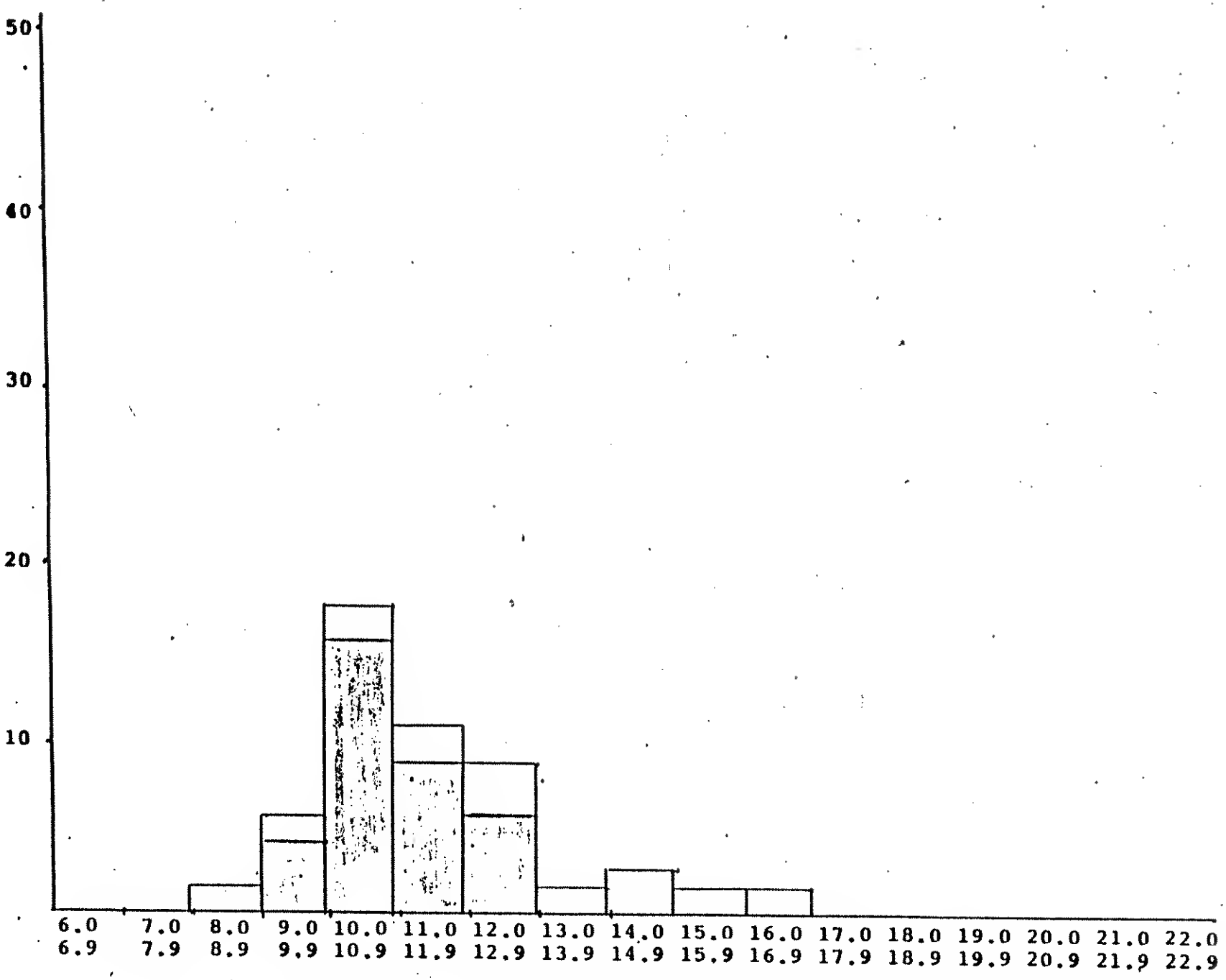


Figure 21 Length frequency of Georgetown Kamloops Rainbow, January 1990 N = 49
Shaded - June 1989 Plant N = 37

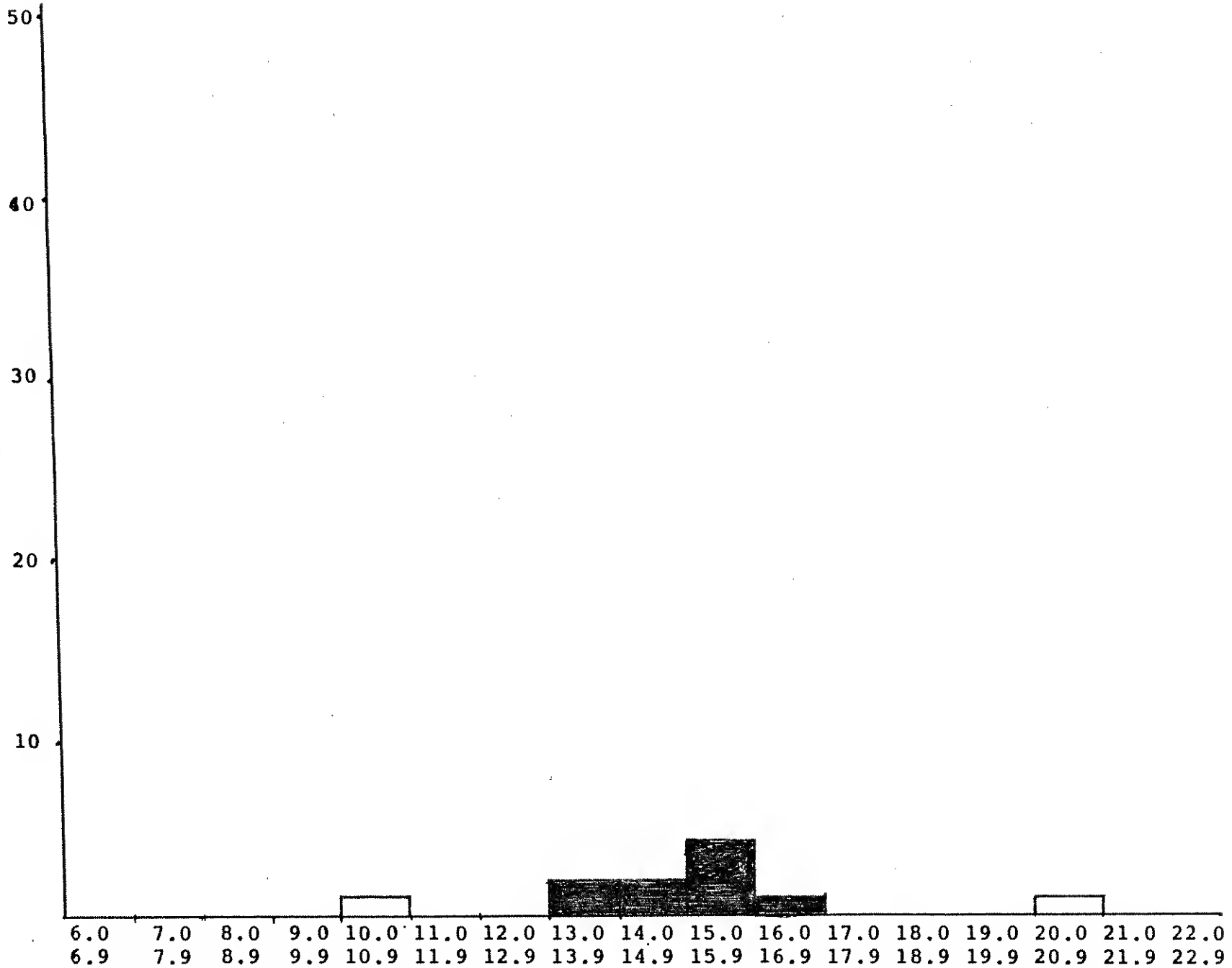


Figure 22. Length frequency of Georgetown Lake Kamloops Rainbow. January 1991. N-11. Shaded June 1989. Plant. N-9.

The Kamloops rainbows have not performed well, in the main, in Georgetown, Figures 21-22. Late stocking dates and apparent poor survival seem to be the contributing factors. A Kamloops taken in October 1989 reached a weight of 10.5 pounds and a length of 27 inches after four growing seasons. During the years 1985-1986 Kamloops contributed 1-4% of the January rainbow catch. In an effort to evaluate alternative stocking strategies, an experimental plant of 28,963 Kamloops was made in June 1989. These find had been held an additional 9 months in the hatchery and averaged 8.3 inches long. Kamloops representation in the catch increased to 13% in January 1990 and 8% in 1991. The yearling Kamloops made up 76% of all Kamloops sampled in 1990 and 82% of those checked in 1991. The 1989 stocked Kamloops had grown 2.7 inches in average length in a 7 month period to reach 11 inches in January 1990 and grew 4.1 inches, average, in the following 12 months to January 1991 reaching an average length of 15.1 inches. It appears, pending economic analysis, that stocking yearling Kamloops is preferable to the use of young of the year for the Georgetown program.

Rainbow spawning runs in the spring of 1991 were composed of fish averaging 17.6 inches in length (Table 6). Forty-two percent of spawners exceeded 18 inches and 10% exceeded 20 inches. A 25.1 inch fish weighing 5.4 pounds was the largest individual handled. These data are little different than those from 1990 spawners (Figures 23 & 24). No estimates of spawner numbers were attempted, but, clearly, thousands of fish were involved. The Georgetown fishing season opens with general stream trout season on the third Saturday in May. In 1991 ice out was somewhat later than normal and opening of fishing somewhat earlier. The result was large concentrations of spawning and prespawning rainbows in areas open to fishing. The accessibility of numbers of big fish resulted in major legal harvest, frequent violations of fishing regulations, and public concern about excessive and unethical harvest. Attempts to prevent repetition of this event are underway and some regulatory response is probable.

Oxygen sampling under ice in 1991 showed 2m of water containing 5 ppm persisted throughout the period of ice cover.

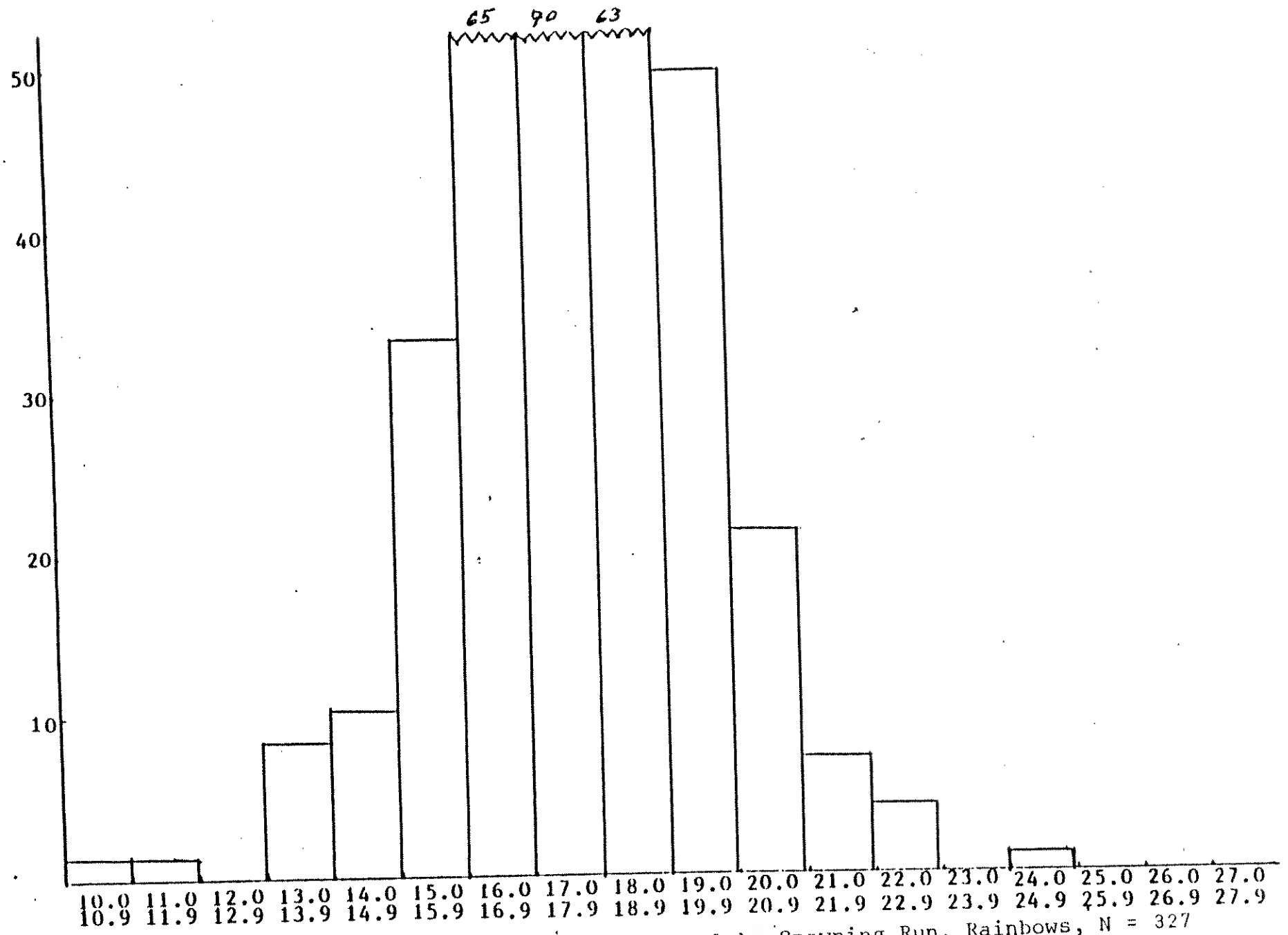


Figure 23. Length Frequency 1990 Georgetown Lake Spawning Run, Rainbows, N = 327

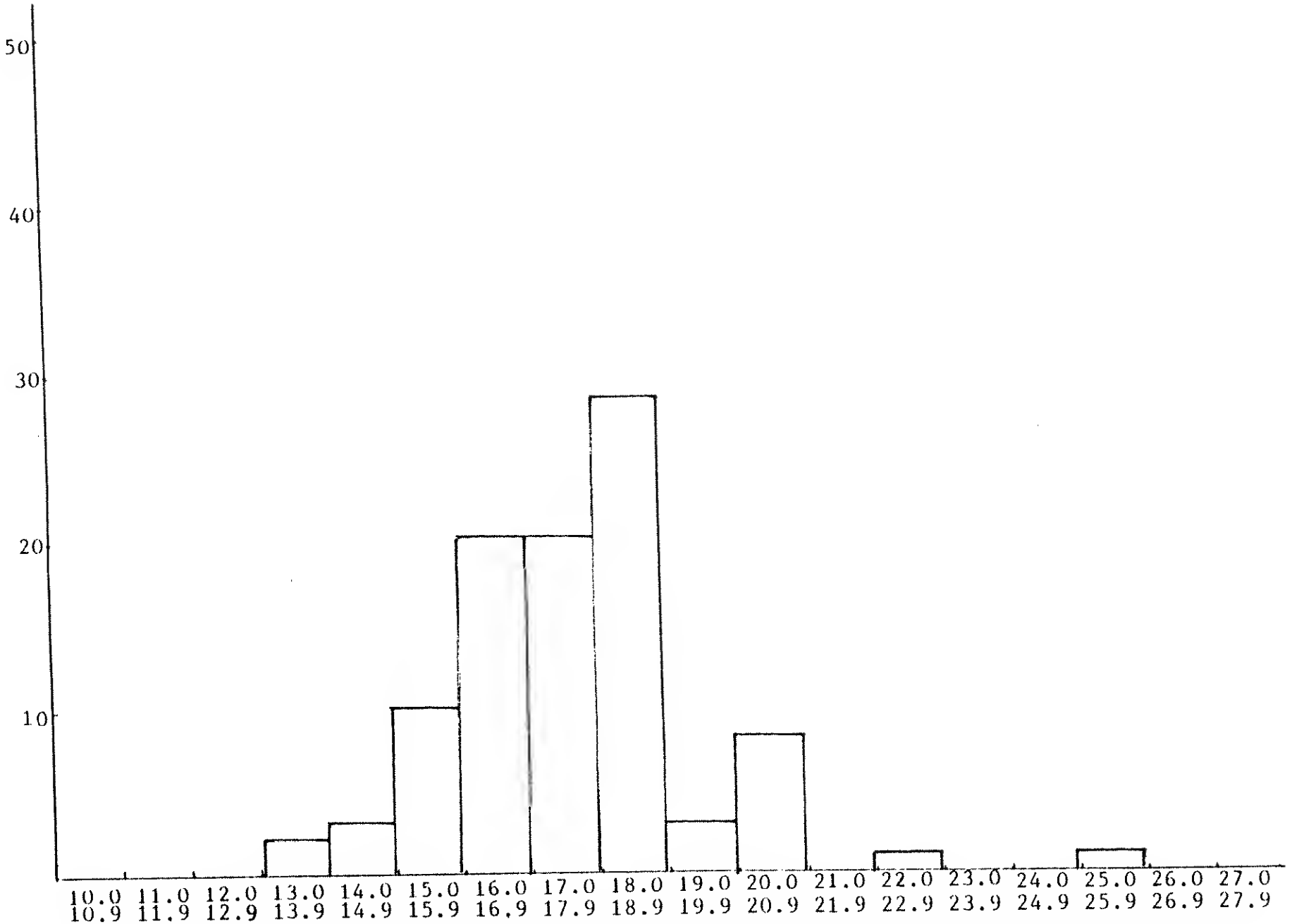


Figure 24. Length frequency 1991 Georgetown Lake Spawning Run. Rainbows, N = 96

Table 6. Georgetown Lake Tributaries Spawning Rainbow Survey, 1991.

North Fork Flint Creek			Stuart Mill Creek		
Date 4/27/90			Date 4/13/90		
Number	51	L 17.6	Number	76	L 17.2
Number Male	28		Number Male	43	
Number Female	23		Number Female	33	
Number Hook Scarred	1		Number Hook Scarred	8	
Date 5/10/90			Date 5/10/90		
Number	50	L 17.4	Number	50	L 18.1
Number Male	31		Number Male	20	
Number Female	19		Number Female	30	
Number Hook Scarred	2		Number Hook Scarred	4	
Date 5/23/90			Date 4/26/90		
Number	50	L 17.5	Number	50	L 17.3
Number Male	26		Number Male	33	
Number Female	24		Number Female	17	
Number Hook Scarred	7		Number Hook Scarred	0	
Date 5/24/91					
Number	96	L 17.6			
Number Male	34				
Number Female	62				
Number Hook Scarred	8				

Table 7. Georgetown Lake 1990-91 under ice dissolved oxygen concentration (ppm).

	Surface	1m	2m	3m	4m	5m
January 3	8.7	8.7	8.7	7.9	6.8	5.2
January	13	13	12.9	9.9	4.1	2.9
February	10.5	11	8.6	7.4	5	4.8
March	7.5	7.5	5.9	4.1	1.7	.7

Waters Referred to:

Georgetown Lake
North Fork of Flint Creek
Stuart Mill Creek

Prepared by: Wayne F. Hadley

Date: August 1991